

## CLAIMS

What is claimed is:

1. A dual mandrel wire winding machine for continuously winding wire alternately on one of two mandrels, comprising:

5        first and second laterally spaced winding mandrels;  
      a traverse for supplying wire alternately to either mandrel;  
      a single transfer arm for transferring wire from one mandrel to another mandrel, said  
          single transfer arm being operative to engage the wire being directed to said first  
          mandrel and position the wire adjacent said second mandrel outwardly of said  
          second mandrel's axis of rotation.

2. The machine of claim 1 where said transfer arm is extendable between retracted and extended positions.

3. The machine of claim 2 wherein in transferring the wire from said first mandrel to said second mandrel, said transfer arm is operative to move the wire underneath said second mandrel and then move the wire upwardly, where the wire is secured to said second mandrel.

4. The machine of claim 3 wherein said transfer arm assumes said retracted position in moving the wire under said second mandrel, and wherein said transfer arm assumes an extended position in moving the wire upwardly to where the wire is secured to said second mandrel.

5. The machine of claim 4 wherein said transfer arm is operative to engage the wire at a position between said two mandrels and to pull the wire downwardly, prior to moving the wire under said second mandrel.

6. The machine of claim 1 wherein said transfer arm is operative to position the wire such that the wire can be secured to said second mandrel at the lower outer quadrant thereof.

7. The machine of claim 2 wherein in transferring the wire from said first mandrel to said second mandrel, said transfer arm engages the wire, retracts and pulls the wire downwardly, rotates and moves the wire under said second mandrel, and extends and moves the wire upwardly where the wire is secured to said second mandrel.

5 8. The machine of claim 1 wherein said transfer arm engages the wire via cooperative actuation of said transfer arm and said traverse.

9. A method of transferring wire from a wound mandrel to an unwound mandrel via a traverse operative to laterally position the wire relative to said mandrels, and a single transfer arm having a wire guide extendably attached thereto, comprising:

10 laterally shifting the wire relative to said wound mandrel;  
 extending said wire guide upwardly past a section of the wire;  
 laterally shifting the wire relative to said wound mandrel such that a section of the wire extends below said wire guide;  
 retracting said wire guide, an engaging the wire with said wire guide and pulling the wire  
 15 downwardly;  
 rotating said transfer arm and moving the wire with the transfer arm;  
 extending said wire guide and directing a section of the wire into a wire receiver associated with said unwound mandrel; and  
 securing the wire to said unwound mandrel.

20 10. The method of claim 9, wherein securing the wire to said unwound mandrel comprises clamping the wire to said unwound mandrel.

11. The method of claim 10, wherein securing the wire to said unwound mandrel further comprises cutting the wire.

25 12. The method of claim 9, wherein securing the wire to said unwound mandrel occurs in response to an end cap being positioned onto said unwound mandrel.

13. The method of claim 9, wherein rotating said transfer arm comprises pivoting said transfer arm about a pivot point located between and beneath the axes of rotation of said mandrels.

14. A method of transferring a wire from a first mandrel to a second mandrel of a dual-mandrel wire winding machine, comprising:

5 directing wire to said first mandrel such that a wire segment extends from said first mandrel;  
transferring the wire to said second mandrel with an extendable and retractable transfer arm; and  
transferring the wire to said second mandrel by selectively extending and retracting said transfer arm such that, in the course of transferring the wire to said second  
10 mandrel, said transfer arm is operative to engage the wire segment extending from said first mandrel and to move at least a portion of the wire segment to a position adjacent said second mandrel, where the wire is secured to said second mandrel.

15. The method of claim 14 including extending said transfer arm, retracting said transfer arm  
said engaging the wire segment extending from said first mandrel, and moving said transfer arm to a position adjacent said second mandrel, where the wire is secured to said second  
mandrel.

16. The method of claim 15 including, after engaging the wire segment, rotating said transfer  
20 arm towards said second mandrel.

17. The method of claim 16 including, after rotating said transfer arm, extending said transfer arm and the wire segment associated therewith such that the wire segment is positioned adjacent said second mandrel for securing thereto.

18. A dual mandrel wire winding machine for continuously winding wire alternately on one of two  
25 mandrels, comprising:

first and second laterally spaced winding mandrels;

a traverse for supplying wire alternately to either mandrel;

a transfer arm for transferring wire from one mandrel to the other mandrel, said transfer arm being pivotally mounted and moveable between a plurality of positions relative to said mandrels, and extendable between retracted and extended positions.

19. The machine of claim 18, where a mounting point of said pivotally mounted transfer arm lies below the axes of rotation of said mandrels.

20. The machine of claim 18, wherein in transferring wire from said first to said second mandrel, said transfer arm both rotates and moves between retracted and extended positions.

21. The machine of claim 18, wherein said transfer arm is operative to transfer the wire from one mandrel to the other by engaging the wire, retracting and pulling the wire generally downwardly, and rotating to move the wire to a position adjacent the other mandrel.

22. The machine of claim 18, further comprising a shaft connected to said transfer arm, said shaft including a plurality of position indicators disposed thereon and radially oriented thereabout.

23. The machine of claim 22, further comprising a plurality of sensors disposed adjacent said shaft, each said sensor operative to detect the proximity of at least one of said position indicators.

24. The machine of claim 23, wherein said sensors comprise magnetic sensors.

25. The machine of claim 18 wherein said transfer arm is operative to transfer the wire from one mandrel to the other mandrel by

extending said transfer arm to a position above the wire;

retracting said transfer arm and engaging the wire and pulling the wire generally downwardly; and

rotating said transfer arm towards the other mandrel and positioning the wire adjacent the other mandrel so the wire can be secured to said other mandrel.

26. The machine of claim 25 wherein after rotation, said transfer arm is operative to extend outward past at least a portion of said other mandrel and position the wire adjacent said other mandrel such that the wire can be secured to said other mandrel.

27. A dual mandrel wire winding machine for continuously winding wire alternately on one of two mandrels, comprising:

first and second laterally spaced winding mandrels;  
a single transfer arm extendable between retracted and extended positions; and  
a traverse for laterally shifting the wire being supplied to either mandrel, said traverse operative to cooperate with said transfer arm by aligning the wire so that said transfer arm engages the wire and moves it to said second mandrel.

28. The machine of claim 27, wherein said traverse cooperates with said transfer arm to transfer wire from said first to said second mandrel by shifting the wire laterally along said first mandrel and, after said transfer arm extends to an extended position proximate said first mandrel, shifting the wire back along said first mandrel such that the wire underlies said transfer arm.

29. The machine of claim 27, wherein said transfer arm includes a reciprocating fluid cylinder operative to move a wire guide associated with said transfer arm between retracted and extended positions.

30. The machine of claim 29, wherein said wire guide is extendable to engage wire between said mandrels and retractable to pull the wire down, and wherein said transfer arm is moveable to a position outward of said mandrels, and wherein said wire guide is extendable to position the wire adjacent one said mandrel.

31. A method of transferring wire from a wound mandrel to an unwound mandrel on a dual mandrel wire winding machine having a single transfer arm, comprising, during the course of the transfer:

extending said transfer arm adjacent said wound mandrel;

retracting said transfer arm to engage the wire; and then  
moving said transfer arm adjacent said unwound mandrel.

32. The method of claim 31, further comprising extending said transfer arm to position the wire  
in a wire retention area on said unwound mandrel.

5 33. The method of claim 31, wherein said wire is engaged between the axes of rotation of said  
wound and unwound mandrels.

34. The method of claim 31, wherein moving said transfer arm comprises rotating said transfer  
arm about a pivot point between and below the axes of rotation of said wound and unwound  
mandrels.

10 35. The method of claim 34, wherein moving said transfer arm further comprises moving said  
transfer arm under said unwound mandrel in the retracted position.

36. The method of claim 34, wherein extending said transfer arm to position the wire comprises  
extending said transfer arm outside of the axis of rotation of said unwound mandrel.